Claims

[c1] 1. Apparatus for harvesting energy from a fluid stream which comprises:

a rotor comprising a plurality of generally planar frames radiating from a common geometric axis, said common geometric axis being coplanar with each of said plurality of generally planar frames; each of said generally planar frames having first and second opposed edges, each of said first opposed edges each being disposed proximate to said common geometric axis, each of said second opposed edges of said frames being disposed in distal relationship to said common geometric axis, each of said first and second generally planar frames having an opening therein;

the apparatus further including a plurality of generally planar flappers, each of said generally planar flappers having first and second opposed edges, each of said first edges of each of said plurality of flappers being hinged to one of said second edges of one of said plurality of frames, each of said generally planar flappers having a part thereof that overlaps at least a part of the frame to which it is mounted when the flapper is disposed in face to face abutting relationship to the frame on which it is mounted so that said flapper will not pass through said opening.

[c2] d[c]

d

2. The apparatus as described in claim 1 wherein each flapper overlaps the frame to which it is mounted along at least two sides thereof wherein said flapper is disposed in face to face abutting relationship to the frame on which it is mounted.

[c3] d[c]

d

3. The apparatus as described in claim 1 wherein each flapper overlaps the frame to which it is mounted along at least four sides thereof wherein said flapper is disposed in face to face abutting relationship to the frame on which it is mounted.

[c4] d[c]

d

4. The apparatus in accordance with claim 1 wherein each of said frames has a first area defined by the periphery of said frame and each of said openings in each of said first frames has a second area defined by said opening, said second area being a substantial part of said first area.

[c5] d[c]

d

5. The apparatus as described in claim 4 wherein said second area is at least 90 percent of the first area,

6. The apparatus as described in clam 1 wherein said rotor includes a sleeve having an axis substantially coincident with

said common geometric axis, said sleeve being dimensioned for mounting on an associated shaft.

[c6] d[c]

d

7. The apparatus as described in claim 1 wherein said rotor includes a shaft having an axis substantially coincident with said common geometric axis, and the apparatus includes bearings supporting said shaft.

[c7] d[c]

d

8. The apparatus as described in claim 1 wherein each part of each of said frames has a dimension in the direction of movement that is smaller than each part of each of said frames in a direction perpendicular to the direction of movement.

[c8] d[c]

d

9. The apparatus as described in claim 1 wherein each of said frames is manufactured of a reinforced composite material.

[c9] d[c]

d

10. The apparatus as described in claim 1 wherein each of said flappers is an imperforate body.

[c10] d[c]

d

11. The apparatus as described in claim 1 wherein each flapper has a dimension in a direction parallel to the common geometric axis that is much greater than the dimension in a direction perpendicular to the common geometric axis.

[c11] d[c]

d

12. The apparatus as described in claim 1 wherein each frame has a dimension in a direction parallel to the common geometric axis that is much greater than the dimension in a direction perpendicular to the common geometric axis.

[c12] d[c]

d

13. The apparatus as described in claim 1 wherein each flapper is generally rectangular.

[c13] d[c]

d

14. The apparatus as described in claim 1 wherein each frame is generally rectangular.

[c14] d[c]

d

15. The apparatus as describing claim 1 wherein each flapper

has a height that is greater than the height of the frame to which it is attached by hinges.

[c15] d[c]

d

16. Apparatus for harvesting energy from a fluid stream which comprises:

a rotor comprising a plurality of elongated supports radiating from a common geometric axis, said; each of said supports having first and second axial extremities, each of said first axial extremities being disposed proximate to said common geometric axis, each of said second axial extremities being disposed in distal relationship to said common geometric axis; the apparatus further including a plurality of generally planar flappers, each of said generally planar flappers having first and second opposed edges, each of said first axial extremities of each of said plurality of flappers being hinged to one of said second axial extremities of one of said plurality of supports, each of said generally planar flappers having a part thereof that overlaps at least a part of the support to which it is mounted when the flapper is disposed in at least one position thereof.

[c16] d[c]

d

17. The apparatus as described in clam 16 wherein said rotor

includes a sleeve having an axis substantially coincident with said common geometric axis, said sleeve being dimensioned for mounting on an associated shaft.

[c17] d[c]

d

18. The apparatus as described in claim 16 wherein said rotor includes a shaft having an axis substantially coincident with said common geometric axis, and the apparatus includes bearings supporting said shaft.

[c18] d[c]

d

19. The apparatus as described in claim 16 wherein each part of each of said supports has a dimension in the direction of movement that is smaller than each part of each of said frames in a direction perpendicular to the direction of movement.

[c19] d[c]

d

20. The apparatus as described in claim 16 wherein each of said flappers is an imperforate body.